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AUTHOR Madjidi, Farzin; Hughes, H. Woodrow; Johnson, Ruth N.; Cary, Kim

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ABSTRACT

Focusing on online learning opportunities in higher education, this paper reviews the various tools of virtual learning and electronic synchronous and asynchronous communication, discusses their strengths and weaknesses, presents strategies for their best use, and warns against potential pitfalls. Implementation issues, including cost and training requirements, are also discussed. An overview of Internet access and synchronous and asynchronous communication modes is provided. The following virtual learning tools are then described: World Wide Web pages, electronic mail, newsgroups, chat rooms, and videoconferencing. The paper concludes that the main challenge associated with virtual learning environments is to overcome the tendency to replicate traditional classroom practices in the virtual environment and to establish a more learner-centered curriculum. Four figures illustrate the Netscape Internet browser, Eudora Pro electronic mail software, newsgroups at Pepperdine University (California), and virtual meeting rooms. (AEF)

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Virtual Learning Environments

Farzin Madjidi, Ed.D.
H. Woodrow Hughes, Ph.D.
Ruth N. Johnson, Ph.D.
Kim Cary, Ed.D. (candidate)
Pepperdine University,
Graduate School of Education and Psychology

Introduction

Higher education in the past ten years has experienced tremendous growth in the number of working adults returning to school to seek college and graduate degrees. Colleges and universities, to better position themselves to participate in this market, have developed programs specifically designed for the needs of this segment of learners. Not too long ago many in academe would frown upon "off-site" programs; yet, today, even the most traditional institutions have adopted some form of distributed learning to meet the needs of their respective audiences.

The 90s also witnessed a giant revolution in learning technology. The most powerful Personal Computers (PCs) became readily available at affordable prices. Soon, with the widespread use of Internet, information technology became a mainstay in higher education. A culture of "look it up on the Web" and "e-mail me" is beginning to replace going to libraries or even making telephone calls.

The result of these two phenomena has been the emergence of a new approach to distance education, online learning. Colleges and universities are now offering a large number of online learning opportunities, from certificate programs to advanced graduate degrees. These programs, while varying a great deal in design, generally incorporate a number of electronic communication tools in their approaches. While the technology for these ventures is readily available, many colleges and universities are struggling with the best application of available technology to their teaching and learning environments. Even for faculty members who are not involved with online programs, the best use of technology still remains a mystery. Some have chosen to put their class material on web pages to be downloaded by students, some utilize electronic presentations to jazz up their lectures, others use electronic bulletin boards and e-mail, while the majority cautiously watch from the sidelines.

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The purpose of this paper is to review the various tools of virtual learning and electronic synchronous and asynchronous communication, discuss their strength and weaknesses, and present strategies for their best use and warn against potential pitfalls. Finally, the paper will discuss implementation issues including cost and training requirements.

Internet Access

Almost all approaches suggested in this paper require access to the Internet. Access to the Internet can be provided either directly and inexpensively through educational institutions, or through an Internet Service Provider (ISP) for around $20 a month for unlimited use.

Once access to the Internet is established, a "Browser" software is required to allow searching, or is more popularly called, surfing the net. For this purpose, a number of browser packages are available, such as Netscape or Internet Explorer. These software packages allow searches on the Internet, downloading files, or gaining access to various Web sites. Basic browser software packages are generally provided for free through ISP and operating software manufacturers, or can be downloaded from the browser software manufacturer directly.

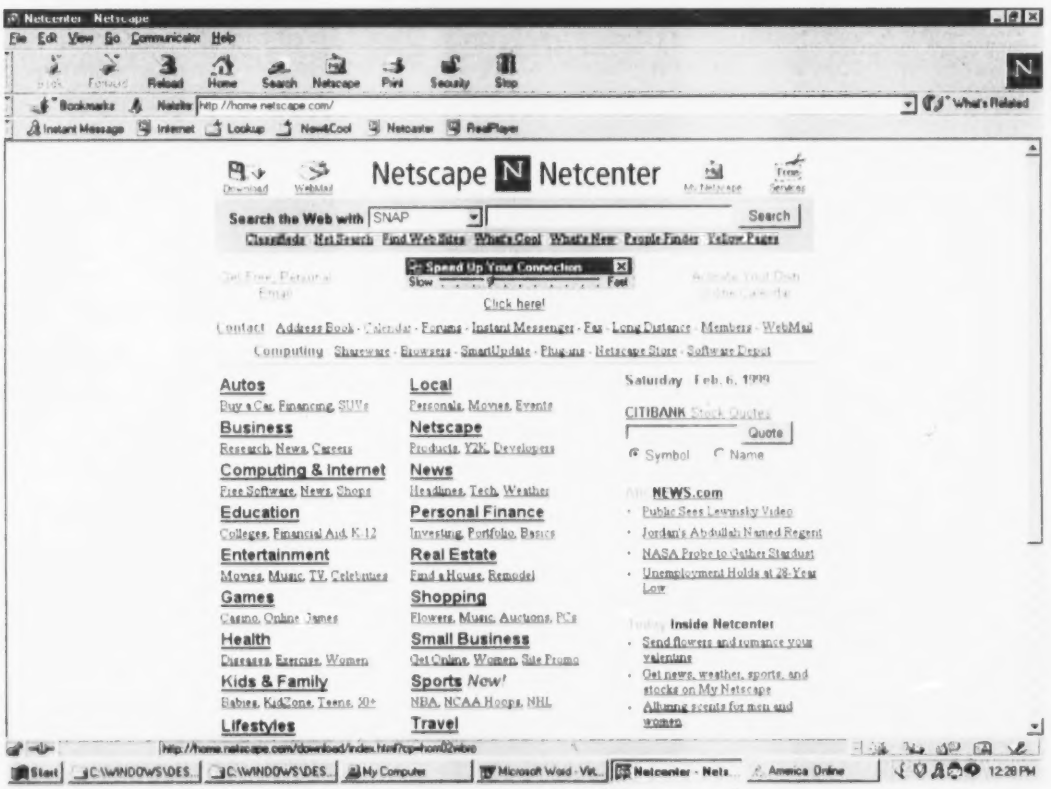

Figure 1. A depiction of Netscape Pro. 4.5, a Web browser software

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Synchronous and Asynchronous Communication
Most electronic communication will generally take place either synchronously, or asynchronously. The two modes are and various uses of each mode is described below:

Asynchronous Communication
Asynchronous (not synchronized) communication is defined as communication that does not occur at regular intervals and generally describes communications in which data are transmitted intermittently. As such, asynchronous modes of communications generally involve an exchange of transmissions, material, discussions, or messages where the sender(s) and the recipient(s) may or may not receive the message immediately. In this sense, a parallel can be drawn with a telephone answering machine where the sender can leave a message so that the receiver can review and respond to it at a later time. Although asynchronous communication can take many different forms, the three most popular applications of it in distributed learning involve web pages, e-mail, and newsgroups.

Web Pages

Web pages serve a variety of functions, from sales and advertising to religious and educational purposes. In the instructional arenas, Web pages are generally used to provide information about the professor, have syllabi and course material available to be downloaded, and provide links to other Web sites that contain relevant material.

Basic Web pages are fairly easy to design and have proven very helpful. They give the instructor the ability to have his/her course material readily available to students and colleagues. Any time a student needs yet another copy of the syllabus, the student can be referred to the Web page. Also, students can have easy access to course material without having to travel to the campus. Some Web pages are used to give students their grades. As such, Web pages are mostly used as an electronic resource library, readily available to the public from anywhere in the world, 24 hours a day.

A major difficulty with Web pages is the issue of protection of intellectual property. It is problematic to limit worldwide access to personally developed course material that is placed on Web sites. In the absence of comprehensive security protocols, there are no safeguards to prevent others from simply copying and commercially using non-copyrighted material. Even if appropriate copyrights are obtained, it is next to impossible to monitor such abuse internationally, particularly given the relaxed nature of intellectual property laws oversees.

Electronic Mail

Electronic mail (e-mail) is perhaps the most popular electronic communication tools. The basic requirements of access to e-mail are simple and inexpensive, namely access to the Internet and an e-mail software package. E-mail software is either provided

free through the ISP or the university, or can be purchased for as little as $20. Like most other software packages, the user can learn the basics of the software with fairly little training, while the more advanced features of the software would require additional training.

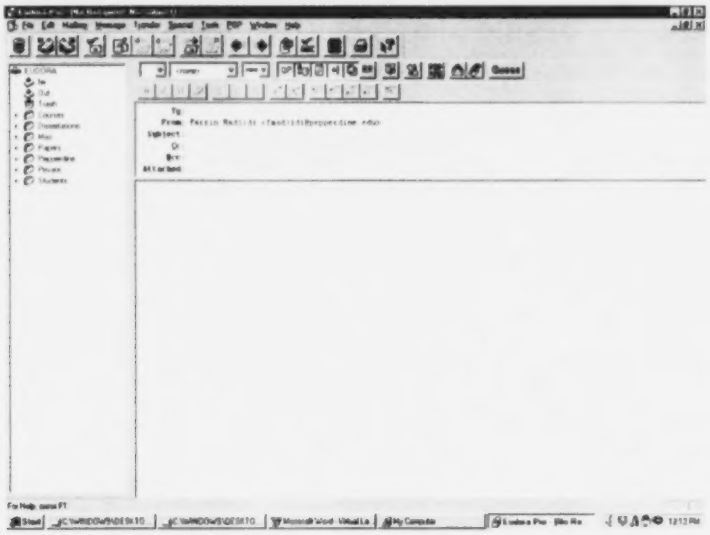

Figure 2: A depiction of Eudora Pro, an electronic mail software

In distributed learning, e-mail can serve a number of functions, the most basic of which is simple communication. One of the more powerful features of e-mail software is the ability to "attach" text, data, graphic files, or Web Addresses or Universal Resource Locators (URLs) to an e-mail message. Once software compatibility and system requirement issues are resolved, students and the faculty can easily exchange assignments, questions, data, or other learning materials.

Attachment can support several learning approaches. From the teaching perspective, faculty can send assignments to their students, reading and support materials, learning resources, URLs to relevant publications or Web sites without having to wait for the next class session. For example, if the New York Times publishes an article five days prior to the next class meeting, the faculty member can through e-mail, send the URL to that article to his/her students anywhere in the world and have them prepare a position paper by the next class session.

From the student's perspective, two distinct benefits emerge. Individually, students, through e-mail, can access their professors with questions or can submit their assignments electronically. When group assignments are given, students can write portions of an assignment, using the attachment feature, group-edit the document, discuss their perspectives about the paper, and collectively review the paper for flow and consistency.

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Some of the difficulties with use of e-mail, as stated earlier, are compatibility of software and the ability to "open" all attachments. To this end, our best advice is requirements for uniform software packages. If all students and the faculty use the same software packages that are cross-platform compatible (useable on Windows as well as Macintosh operating systems), many of these compatibility issues will be resolved. The last obstacle on this front would be opening sound and graphic files that require their own software. Again, this problem can be resolved if all participants use the same sound and graphic software packages.

Newsgroups

Newsgroups or electronic bulletin boards allow users to post comments, documents and URLs to a common Internet location. These materials can then be downloaded, discussed and viewed by other users. A unique and most useful feature of Newsgroups is the "Threading" feature. That is, once a line of inquiry (a thread) has begun all the responses to that line of inquiry can be contained within the thread, while other lines of inquiry may be pursued in other threads. This ability to manage dialogues on multiple topics presents many advantages to distributed learning.

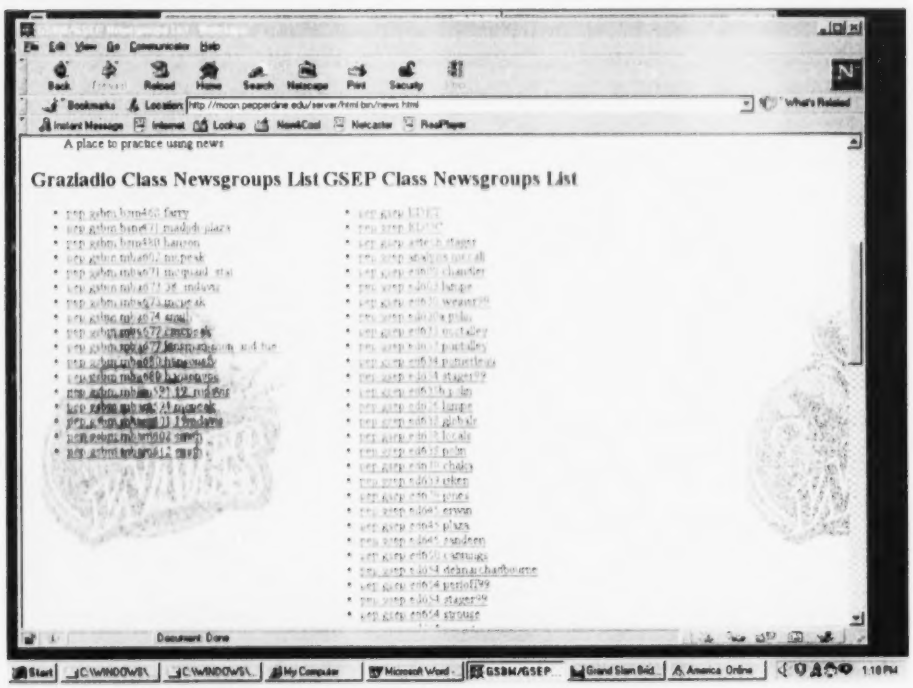

Figure 3: A depiction of Newsgroups at Pepperdine University

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Application of Newsgroups in distributed learning models have been popular and proven effective. Entire college degree programs are offered nationally that are mainly presented through Newsgroups. Newsgroups can be used as a community bulletin board in which common resources are posted and shared. Articles, data, or URLs can be placed in Newsgroups throughout the duration of the course to provide repeated access for students. But mainly, the best use of Newsgroups is to conduct on-going discussion of course material. Suppose a recent article in a national publication is germane to a course topic. This article can be posted to the Newsgroup, in its own thread, for class discussion. Students would then read the article and respond to questions posed by the instructor. Other students could not only post their own responses, but also respond to another student's response, thus creating a new thread. The entire dialogue is time and location independent. The instructor can then monitor the Newsgroup and moderate the discussion. A rich and in-depth discussion is thus generated that explores the topic without having to gather at a central location and predetermined time. This interaction can be further enhanced by opening the Newsgroup to outside visitors such as other faculty members, students taking other courses, students and faculty at any school anywhere in the world, or authors and policy makers. A colleague reported that in a Newsgroup discussion in a doctoral course on leadership, a debate arose among students regarding an issue presented in a recently published book on leadership. The instructor e-mailed the author who lived several thousand miles away and the author participated in the discussion and provided much needed clarity!

There are a number of other possible academic uses for Newsgroups:

1. Reading or Topical Discussions:
   Favorite in class discussion techniques such as jigsaw can be used on the Newsgroup. For example, the instructor can pose questions regarding an assigned reading and ask students to respond to the instructor's original questions, and pose their own questions for other students to discuss.

2. Interclass Communication:
   As alluded to earlier, students in other sections of the same course, related courses, or even other universities with interest in the same topic can be invited to join a discussion on an academic topic. At Pepperdine University's Graduate School of Education and Psychology, this technique has been successfully used and discussions have even included students in other countries.

3. Guest Expert:
   A book, monograph, or article published by an expert can be assigned for reading. Based on their readings, students would then post questions on the Newsgroup. Similarly, students may pose general question in the area of the author's expertise to be answered by the guest expert. The author (expert) would then answer these questions on the Newsgroup. A record of the entire exchange can be electronically maintained for discussion and review in future

classes. This technique provides an excellent opportunity to have a renowned colleague join a class without the extensive requirements of travel.

4. Assignment Submission:
   Students can post their written assignments in the Newsgroup. The twist here over other forms of electronic submission is that other students in the course can read and comment on the assignment.

5. Campus Quadrangle:
   Newsgroups can become a place where geographically dispersed students with differing schedules can "hang out". The Newsgroup can be used for academic discussions, or to provide a forum for general conversations. Some real community learning gems have emerged from this use of Newsgroups.

6. Instructor Broadcast:
   The instructor can post procedures, assignments, calendars and/or syllabus in the Newsgroup. Any self-generated material that would normally be handed out on paper can be posted in the Newsgroup. Some instructors have used this method exclusively for their course handouts. This approach allows questions about an assignment posted with the original item. The thread can be used for follow up questions. Your answer's to one student's question can be read by other students, thus reducing the endless number of questions you have already answered!

7. Collaborative Writing:
   Students can use the discussion threads to develop their thoughts on a topic (or project) and actually write collaboratively in a round-robin or iterative style.

8. Post Web pages:
   If you have some web page content that you want to share with students, you can simply attach the URL for the page in Netscape to the posting on the Newsgroup. Students will see the page right in the Newsgroup message when they access it through Netscape.

Moderating Newsgroup discussions requires practice and skill. If not moderated effectively, discussions can get sidetracked into ancillary issues no longer germane to the topic. To this end, the instructor needs to monitor his/her Newsgroup regularly, provide feedback to students through the Newsgroup to ensure that the topic remains on track, and encourage all participants to also stay on point. The need for this effort will only be amplified if the Newsgroup is open to scrutiny by the larger educational arenas. In either case, the time demands on instructors are extensive.

Synchronous Communication

Unlike asynchronous communication, synchronous communication allows simultaneous transmissions by both the sender and the receiver. An analogy can be drawn to a telephone conversation in which both parties are speaking simultaneously. Clearly, such approach on the telephone would be confusing and counterproductive. However, using computers, a simultaneous transmission by the sender and the receiver can be tracked without a similar confusion.

Synchronous communication can be used in many different formats. Some of the more popular approaches are chat rooms and video conferencing.

Chat Rooms

Chat rooms are virtual environments stored on the Web designed to accommodate a simultaneous, text-based conversation among multiple users. It should be noted that although voice communication technology is readily applicable to chat rooms, such application would merely duplicate a conference call.

These virtual environments can be created through the Multi-User Dimension "MUD" software, or by logging on to Stanford Research Institute's Tapped-In domain. Students with their study groups are assigned specific "Virtual Meeting Room (VMR)" areas similar to "chat rooms." In these VMRs, the study groups meet and discuss the various course-related topics. Typically, students would type their comments, questions, and responses through a dialogue box and transmit it to the VMR through a send feature. Their message will then appear next to their names, on the screens of all those who are logged on to the VMR.

A number of discussion management tools and features are used that allows the course leader to facilitate and manage these conversations in the VMR. For example, "virtual furniture" such as conference tables and chairs can be placed in the VMR. Students in a VMR may "sit" at any of the conference tables in a VMR. However, once a student sits at a conference table, the computer will direct to that student only those messages that are generated on that conference table. Through special commands, students or the facilitator can broadcast a message to all others in the VMR regardless of where they may be sitting. Yet other features allow the facilitator to send a private message to a student by "whispering" to that student. The text of all messages broadcast during a session can be electronically recorded and later e-mailed to all participants.

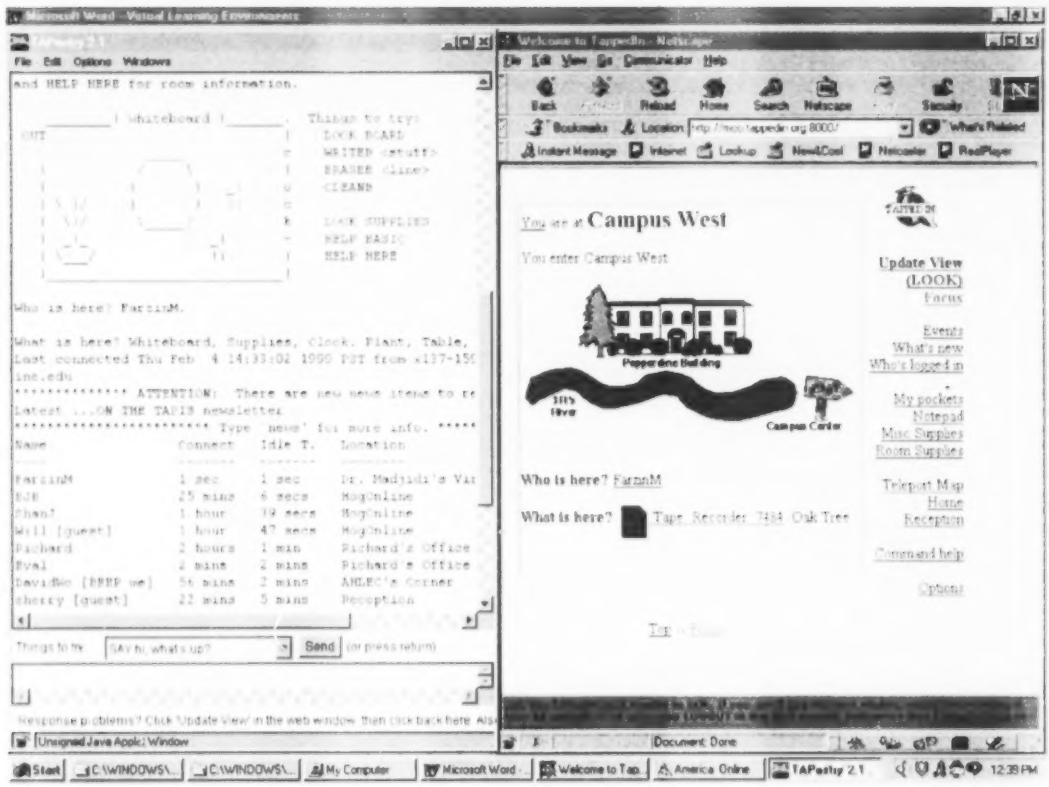

Figure 4: A depiction of Virtual Meeting Rooms as provided by the Tapped In project at the Stanford Research Institute

Finally, VMRs can be equipped with bulletin boards to leave messages on and white boards on which text and diagrams can be posted or drawn. In fact, any feature in a classroom can be replicated in the virtual environment with relative ease.

Advantages of chat rooms in virtual learning environments are numerous. Most importantly, the direct interchange between the facilitator and the students is invaluable. Unlike asynchronous modes of communication, question generated by students can be answered immediately by the facilitator and other students allowing follow up questions and discussions. The transcripts generated in the VMR can serve as learning notes for all participants and assist those who may miss a session by providing detailed records. Also, the system is very cost effective and can be purchased and implemented for a relatively low cost of under $10,000.

Training to use the software used in VMRs is a relatively simple task, particularly to an intermediate or advanced user. The difficulty arises in the actual management of the discussion. An unskilled facilitator may find him/herself in a situation where a larger number of posts and sidebar conversations are rapidly flying across the screen before

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he/she has had an opportunity to respond to them. Another difficulty is securing competent technical staff to update, monitor and troubleshoot the system.

Video Conferencing

Video conferencing entails attachment of small digital cameras to a computer and transmitting that video stream generated to several users using the Internet. In a learning environment, students and the facilitator will all log on to a central location on the Internet and through the digital camera, have their live picture appear on the screens of all the participants. The facilitator has the ability to "direct" the conversation by controlling the feed coming from all participants and to limit the voice conversation to any student s/he decides appropriate.

The advantage of the video conferencing over chat rooms is the presence of the live picture. Such capability may enhance the level of communication and also allow the students to more readily build a learning community through direct interactions with other humans who are no longer just a name on a screen.

At this point in time, technical issues with transmission speed and bandwidth capacity limit the practical application of video conferencing. Yet this technology remains irreplaceable when the physical presence of one of the participants is highly desired.

Training and cost can also create challenges. Even though a camera can be purchased and installed for under $200 and the communication software is relatively inexpensive. However, the amount and the level of technical talent required to meet the communications needs of an off-site degree program are quite costly. The hardware and software setups are comparable in effort to setting up any advanced computer accessory. In addition to this "normal" setup effort, video conferencing also requires considerable amounts of testing time after installation and set up are completed. A major feature of this process is the "dialing in" the microphone and video settings for the best audio and image quality. This is not just a fine-tuning procedure, but these settings, individual to each environment and computer, can make or break the entire communication medium.

While individual pieces of equipment used for this medium may be inexpensive, regular and reliable multiple-party videoconferencing can require serves and software that would cost in excess of $10,000 for a complete setup. These setups provide a fixed point at which instructors and students can find each other, and which has the features and capacity to host multiple conferences.

The value of this technology to our students so far has been in reinforcing a sense of community through the ability to hear a voice and see a face. This seems to have been a motivating factor in assigning students to overcome technological barriers, and to begin using this technology with their classmates and instructors.

Conclusions and Recommendations

There is a clear trend in higher education toward distributed learning. Internet will play a central role in most distributed delivery systems. As discussed in this paper, there are a number of tools readily available to assist in virtual learning environments in degree programs. These opportunities can take advantage of both synchronous and asynchronous modes of communication.

Each method of using internet-based delivery system for instruction has advantages and challenges associated with it. The advantages cluster around expanding access to higher education. The challenges discussed fall into two categories, the technology itself, and the application of that technology in learning.

Technology by itself is seldom the main difficulty in virtual learning environments. Most application software related to virtual learning environments is relatively user-friendly and easy to learn. Although training is required, that training can be provided as part of any in-service training program.

The main challenge associated with virtual learning environments is to overcome the tendency to replicate present classroom practices in the virtual environment. Instead, instructors will need to revise their curriculum to involve students more in the learning activities and adopt a more facilitator, than lecturer mode. Although customized training can be provided in this area, there is very little literature available to support the development of such training. In our opinion, the most relevant literature for such training is that which describes adult learning and andragogy. Also, it is our experience that those who are new to this approach should start at a simple level and expand their virtual learning activities, as they become more skilled in their application.

Finally, the best resource for implementing and improving current virtual learning applications is to rely on more experienced colleagues. There are also a number of national and local conferences that concentrate on this topic that can prove quite helpful.